THE JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR *AT ZERO, FIFTY, AND ONE HUNDRED*

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The experimental content areas represented in *JEAB* in its first volume (1958) and 50 years later in Volume 87 are in many ways similar with regard to research on schedules of reinforcement, research with human subjects, and several other topics. Experimental analysis has not been displaced by quantitative analysis. Much less research on aversive control has been published in recent than in earlier years. Wishes for progress in the next 50 years include experiments on verbal behavior, the sources of novel behavior, and observing responses based on stimuli correlated with escape or avoidance.

Key words: schedules of reinforcement, stimulus control, aversive control, verbal behavior, molecular versus molar, novel behavior, human behavior

In the mid-1950s, even newcomers to behavior analysis could quickly catch up with and stay abreast of the past and current literature of the field. *The Behavior of Organisms* (Skinner, 1938) was of course essential reading, but many had started with *Principles of Psychology* (Keller & Schoenfeld, 1950). *Science and Human Behavior* (Skinner, 1953) also was recently available, but for those especially interested in data it had less appeal than the other two works. Relevant articles had appeared from time to time in the *Journal of Experimental Psychology*, the *Journal of Comparative and Physiological Psychology*, and other journals (e.g., Anger, 1956; Antonitis, 1951; Guttman & Kalish, 1956; Herrnstein & Morse, 1957; Sidman, 1953), and it was easy to find them. Scanning the contents of even a decade of past volumes of the most likely journals was a task that could be accomplished in an afternoon.

Then came *JEAB*. It had been founded because those other journals were sometimes unreceptive to the behavior-analytic literature and did not consistently share an interest in the behavior of individual organisms. Its origins and history have been described elsewhere in some detail, especially in a special section of *JEAB* published in its thirtieth year (Hineline & Laties, 1987). I will not attempt to recapitulate them here.

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At the time I was an undergraduate at Columbia College. Significant recent events were the publication of *Verbal Behavior* (Skinner, 1957), which appeared during the spring semester of my senior year, followed later that year by *Schedules of Reinforcement* (Ferster & Skinner, 1957). Needless to say, the birth of a new journal was eagerly awaited by students and faculty alike. I became a charter subscriber to *JEAB* as a matter of course; then, as now, a student subscription was a real bargain.

THE FIRST VOLUME: *JEAB* AT ZERO

The archival portion of the first issue of *JEAB* consisted of 108 pages that contained a dozen or so substantial articles and a number of technical notes. The exact count will vary with the reader's criteria for whether a contribution belongs in the former or the latter category; for example, based on its very title, a seminal article on animal psychophysics (Blough, 1958) can justifiably be counted as primarily methodological. The table of contents of Volume 1 lists 41 articles and 19 technical notes, but some of the former are devoted entirely to procedural details (Dinsmoor, 1958; Herndon et al., 1958) while some of the latter include data (Church, 1958; Verhave, 1958b).

The journal began as a quarterly (it went bimonthly after its sixth year); by the end of its first year, 380 archival pages had been published in its four issues. Over the year, page layouts and fonts and reference formats varied across articles and issues. Cumulative records

were a common but not universal form of data presentation; roughly two-thirds of the experimental (as opposed to technical) papers included cumulative records.

What a year it was! To peruse the contents is to marvel at the range of research topics and at the sophistication of the analyses. It is no surprise that research on schedules of reinforcement was prominent. Topics included parametric studies of schedules (Clark, 1958; Cumming & Schoenfeld, 1958; Hearst, 1958), explorations of new contingencies (Herrnstein & Morse, 1958), schedule transitions (Gollub & Urban, 1958), and effects of response units on schedule performances (Ferster, 1958; Findley, 1958), to mention just some of the contributions. Furthermore, three schedule experiments, including one with human subjects, were devoted to studies of drug effects (Dews, 1958; Dews & Morse, 1958; Herrnstein, 1958). Psychopharmacology was thus represented in *JEAB* from the outset; another article in the first volume examined drug effects on avoidance behavior (Verhave, 1958a).

It is difficult to disentangle research on schedules from research on stimulus control. Studies included schedule interactions (Herrnstein & Brady, 1958), generalization gradients (Pierrel, 1958), and effects of stimuli correlated with noncontingent reinforcer deliveries (Morse & Skinner, 1958). Analyses of the relations among stimulus control, conditioned reinforcers, and the maintenance of observing responses had begun (Kelleher, 1958a, b). Animal psychophysics required especially sharp stimulus control (Blough, 1958), and analogous procedures involving response sequences (Mechner, 1958) set the stage for analyses of an organism's discrimination of its own behavior.

Standard response classes such as lever presses and key pecks dominated in that first volume, but other classes, such as wheel running (Skinner & Morse, 1958), also were considered. Food typically served as the reinforcer, but attention also was given to other reinforcing consequences, such as the opportunity to groom (Falk, 1958).

Several articles were devoted to aversive control. The coverage included escape (Dinsmoor & Winograd, 1958), avoidance (Brodie & Boren, 1958; Sidman, 1958b), punishment in relation to other contingencies (Azrin, 1958), and conditioned suppression (Sidman, 1958a; Stein, Sidman, & Brady, 1958). Research on aversive control was extended to physiological variables in studies of the relation between avoidance responding and ulcers (Brady, Porter, Conrad, & Mason, 1958).

Experimental subjects included pigeons and rats and chimpanzees, but a number of papers included work with humans, and especially on schedules of reinforcement both with adults (Holland, 1958) and during development (Bijou, 1958; Long, Hammack, May, & Campbell, 1958). The human research included aversive control (Azrin, 1958), and the seeds of application were evident in work on the treatment of stuttering (Flanagan, Goldiamond, & Azrin, 1958).

At first blush what seems lacking is research on verbal behavior, and yet this topic figured prominently in the very lead article of the first issue: Keller's debunking of the phantom plateau, the purported break in the progress of Morse-code learning midway on the route to mastery (Keller, 1958). Morse code, in which letters of the alphabet correspond to patterns of dots and dashes, was the medium for communication in the early days of telegraphy; ''JEAB'' would be transmitted as • − − − / • / • − / − • • • in Morse code. World War II created an urgent demand for skilled telegraphers, and Keller had developed an effective instructional program for the military called the code–voice method, one component of which was learning to respond with appropriate letters upon hearing progressively more complex Morse code sequences, much as a child is taught to write letters of the alphabet and eventually words upon hearing them.

Early researchers had found that during the learning of Morse code the rate at which code could be received increased at first and then leveled off for a time (the plateau) before again increasing. Keller showed that the plateau was an artifact of changes in verbal units, as learners moved from responding to individual letters of code to longer sequences corresponding to words and eventually phrases. The relations among the verbal stimuli and responses in Morse-code learning formally correspond to those among the verbal stimuli and responses in Skinner's verbal classes (Skinner, 1957). The one-to-one correspondences between letters and their dot–dash patterns are similar to (and just as arbitrary as) those between spoken and written

letters in textual behavior or in dictation-taking. In other words, though it may have gone unnoticed, verbal behavior was there in *JEAB* from the very beginning.

One other special piece was Sidman's tour de force, ''By-products of aversive control'' (Sidman, 1958a). It documented the details of an attempt to generate simultaneous suppression of one response and enhancement of another in an individual organism in a study of the interactions of avoidance histories and conditioned suppression. As an example of the experimental analysis of behavior, it illustrated the advantages of exploring contingencies as opposed to following predetermined research designs, and it foreshadowed the seminal methodological text, *Tactics of Scientific Research*, that was soon to follow (Sidman, 1960). The first volume of *JEAB* set high standards for those that would follow.

VOLUME 87: *JEAB* AT FIFTY

What do we find in *JEAB* 50 years later? As of this writing, I can report on only part of its fiftieth year of publication. Now that the journal appears in two volumes per year, all that is so far available is Volume 87, made up of the January, March, and May 2007 issues with a total of 440 archival pages. Only a very few examples of cumulative records appear in the experimental articles, and technical notes are rare though not totally absent (Anger & Schachtman, 2007). The contents include a memorial appreciation (Timberlake, 2007, on Dinsmoor) and book reviews (e.g., Rachlin, 2007), as well as theoretical articles and reviews (Fantino & Romanowich, 2007; Navakatikyan, 2007; Thompson, 2007). The evolution of book reviews and other special features in *JEAB* is well documented elsewhere (cf. Catania & Hineline, 1996), so I restrict my comments to the experimental content of Volume 87.

It is easy to account for some features of the current contents. For example, now that the *Journal of Applied Behavior Analysis* is available for the publication of applications, it is no surprise that applied articles are rare. The range of topics otherwise corresponds in many ways to that of Volume 1. Schedules of reinforcement of course remain a major component (e.g., Davison & Baum, 2007; Gallistel et al., 2007; Green, Myerson, Shah, Estle, & Holt, 2007; Ludvig, Conover, & Shizgal, 2007; Singer, Berry, & Zentall, 2007), with extensions to physiological variables. Psychopharmacology is not much in evidence, but it has been well represented in other recent volumes, and behavioral economics has provided some new interpretive tools (Madden, Smethells, Ewan, & Hursh, 2007). The analysis of stimulus control has become ever more sophisticated (Cohn & Weiss, 2007; Sargisson & White, 2007; Swaddle & Johnson, 2007). The issue of behavioral units has not gone away (Bachá-Mendez, Reid, & Mendoza-Soylovna, 2007). And behavior analysis continues to be extended to new areas and new research tools, as in neuroimaging (Schlund, Hoehn-Saric, & Cataldo, 2007).

I must confess that when I undertook my review of Volume 87 I fully expected to find several examples of quantitative analyses that had been undertaken at the expense of experimental analyses. The flight to mathematical models was one of the temptations that Skinner had cited in his discussion of the flight from the laboratory (Skinner, 1961), and the proliferation of quantitative analyses seemed a manifestation of that flight within behavior analysis itself. But even those articles concentrating on the goodness of fit of data sets to the matching law or one of its variations have experimentally analyzed the contributions of the different variables that acted on the measured behavior. I worry still that something important is lost when relative rates substitute for absolute rates, especially when differences in absolute rates are not incorporated into the variances accounted for by statistical fits to relative rates (Catania, 1981), but the practice in *JEAB* of including the data sets along with their derivatives typically ameliorates this concern. And I myself have probably been guilty occasionally of some of the practices I might have criticized.

Despite the argument that we are in the midst of a paradigm shift from molecular to molar analyses (Baum, 2002), I see little evidence of such a shift and even suspect an accelerating move in the opposite direction. The dichotomy is an artificial one. Even interresponse time distributions and other detailed measures of behavior are based on aggregations over time, and the devil is typically in the details (e.g., Davison & Baum, 2007). But I have argued this case more

extensively elsewhere (Catania, 1993, 2005). The experimental analysis of behavior remains alive and well in *JEAB* (e.g., Vasconcelos, Urcuioli, & Lionello-DeNolf, 2007a, b; Zentall & Singer, 2007), and it is especially gratifying to find Sidman (2007) continuing to extol its virtues in the pages of this volume.

One other unconfirmed expectation involves research on human behavior. My impression had been that it was becoming less often represented in *JEAB*, especially given the availability as a publication outlet of *The Analysis of Verbal Behavior*. But research on the development of verbal behavior and the formation of stimulus classes in humans is a major component of the articles in Volume 87 (Debert, Matos, & McIlvane, 2007; Fields et al., 2007; Horne & Erjavec, 2007; Horne, Lowe, & Harris, 2007; Luciano, Becerra, & Valverde, 2007).

Research on human behavior therefore does not seem threatened, but a different topic seems to be in jeopardy. The analysis of aversive control has almost vanished from *JEAB*. The sole exception in Volume 87 is an article on aversive control with humans, on the effectiveness of restraint as a punisher of stereotyped behavior in autism (Doughty, Anderson, Doughty, Williams, & Saunders, 2007). Has the conduct and publication of research on punishment and escape and avoidance and conditioned suppression and related phenomena been punished? At the least, it has not been much reinforced. It is probably relevant that the links in the initiating chains for such research (Gollub, 1977) have become extended with the interposition of Institutional Review Boards and the corollary requirement that experimental protocols be specified in advance. Could Sidman's (1958a) tour de force have been conducted in a contemporary laboratory?

Have we learned enough about aversive-control phenomena in the past half-century that we do not need to study them any more? How much do we know about conditioned punishers as they may operate in extended chains and other complex schedules (e.g., Silverman, 1971), and can we afford the assumption that differences between reinforcement and punishment are essentially matters of changes in sign? In a world so filled with aversive events that enter into various contingencies with behavior (Perone, 2003), can we entertain any extensions of our applications without continuing or expanding our experimental analyses of these phenomena?

THREE WISHES FOR *JEAB* AT ONE HUNDRED

It is presumptuous to make predictions for half a century from now, but my guess is that our greatest worry is whether *JEAB*, dependent as it is on a culture that will face various global crises in the coming decades, will survive and prosper through those times. Under any circumstances the journal will certainly take a different form as a consequence of technical innovations, not the least of which is electronic publication.

We must hope that the costs of *JEAB* will allow it to remain widely available. As the expenses of publication become less important, editorial criteria can concentrate on substantive questions. Editorial decisions are a type of signal detection (Green, 2004; Nevin, 1969; Swets, 1992), in which the costs of misses (rejections of articles that in retrospect should have been published) must be weighed against the costs of false alarms (acceptance of articles that in retrospect included problems that should have precluded publication). Once editorial and production costs are removed from the signal-detection equation, the major costs are those to *JEAB*'s authors and readers. For example, what are the effects of acceptance or rejection on an author's grant funding or promotion, or on the time a reader devotes to following up on another researcher's findings or representing that research to students?

But what about the substantive content of the journal? What will *JEAB* be like at one hundred? To speculate on its content at that time is pretty much to make a wish list, so I will limit myself to three wishes corresponding to three content areas: verbal behavior; novel behavior; and aversive control in its interaction with stimulus control.

Verbal behavior has lately had increasing attention as it has been applied to the treatment of children along the autism spectrum (e.g., Greer & Ross, 2004), but beyond the shaping of verbal classes in such applications we need to know more about the interactions among verbal classes. For exam-

ple, if in verbal governance what one says may come to govern what one does, does it matter how one's verbal behavior was initially established? If we have the choice between instructing verbal behavior or shaping it, which will be more effective in verbal governance? These questions are crucial as we attempt to extend our analyses of verbal behavior to larger human issues such as politics and education and religion. I have elsewhere participated in suggesting specific experiments (Catania & Shimoff, 1998), so my first wish is that the human research that has been so amply represented in *JEAB* at fifty years continues to expand and to provide us with new insights into verbal behavior.

The issue of novel behavior is intimately entwined with that of verbal behavior. One reason is that the attack on Skinner's *Verbal Behavior* by Chomsky (1959) was particularly predicated on the argument that Skinner could not deal with productivity, or the emergence of novel utterances during language development. In fact, behavior analysis has multiple sources of novelty in its armamentarium (e.g., Catania, 2006, Chap. 9), including shaping, fading, adduction, the direct reinforcement of novelty, various types of transfer, and the emergence of new members of higher-order classes. I see no reason to think we have exhausted the possibilities. My guess is that it will be important to emphasize the functional requirements of novel behavior rather than its structural properties, and that interesting insights may be gained by considering the compatibility or incompatibility of contingencies at various levels when some classes are nested in others (e.g., in verbally governed behavior, different contingencies may operate at the level of following particular instructions and at the higher-order level of instruction-following in general). My second wish, therefore, is that the burgeoning progress we have seen in research on modeling and the creation of equivalences and other relational classes continues apace, so that we can develop a principled taxonomy of the varieties of novel behavior and, while doing so, put the Chomskian aspersions finally to rest.

I already have expressed my concern about the area of aversive control, and I make my case here for our need to know more about it in the context of another crucial experimental area. Our understanding of stimulus control has been vastly enriched by the analysis of observing behavior (e.g., Dinsmoor, 1985, 1995a, b). In particular, *contra* much of the lore of cognitive psychology, organisms are not so much information processors as reinforcement processors. We look at stimuli not because of the information they provide but because they are differentially correlated with reinforcers. Organisms are more likely to observe stimuli correlated with reinforcers than those correlated with extinction, or those correlated with reinforcement alone than those correlated with reinforcement plus punishment. But we do often seek out potentially aversive information. If reinforcers maintain observing, we must ask what maintains such behavior when the consequences may be bad news. Why does the mother check on the crying child or the patient call in for a medical diagnosis?

It would seem plausible that stimuli differentially correlated with avoidance or escape contingencies ought to maintain observing behavior, but I know of no examples in the available literature on aversive control. This is not the place for detailed protocols, but an appropriate experimental preparation might include schedules in which aversive stimuli were avoidable during one component and unavoidable during the other (as in Bersh & Lambert, 1975), with appropriate procedures for yoking shock densities (e.g., Hineline, 1970). By analogy with corresponding contingencies involving reinforcement and extinction, would observing responses be maintained if they produced only the avoidance stimulus but not if they produced only the stimulus during which aversive events were unavoidable? My guess is that we are more likely to observe stimuli correlated with aversive events when we can do something about those events, in the sense of having a history of escape or avoidance, than when those events are inevitable. My third wish, therefore, is for renewed attention to aversive control, and for research that addresses this issue in particular.

Congratulations to *JEAB* at 50 and best wishes for its next half-century. I have offered my list of wishes. It remains to be seen whether any present or future readers will undertake to fulfill one or more of them, but I am confident that, as each new issue appears, the forthcom-

ing articles in *JEAB* will continue to maintain my observing behavior.

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